

CLAIMS

What is claimed and desired to be secured by Letters Patent is as follows:

1. A reinforced filtration cartridge having an inlet for receiving fluid to be filtered, and an outlet for removing filtered fluid, said cartridge comprising:
a housing having first and second ends and an interior surface;
first and second end fittings secured respectively to said first and second ends of said housing;
a potted end cap disposed within each of said first and second end fittings;
at least one membrane bundle extending between said first and second end fittings, said membrane bundle being coupled with said inlet; and
at least one support column having first and second ends extending between said first and second end fittings, such that said first and second ends are embedded within said potted end cap without extending through said potted end cap.
2. The filtration cartridge of claim 1, wherein said at least one membrane bundle comprises at least one tubular membrane.
3. The filtration cartridge of claim 1, wherein said at least one membrane bundle comprises a plurality of hollow fiber membranes.
4. The filtration cartridge of claim 1, wherein said at least one support column is substantially solid.
5. The filtration cartridge of claim 1, wherein said housing and said first and second end fittings are substantially cylindrical.
6. The filtration cartridge of claim 1, wherein said at least one membrane bundle comprises at least two membrane bundles, and wherein said at least one support column comprises a

tube having an outer wall and an inner channel, and wherein at least one of said at least one membrane bundles is contained within said support column.

7. The filtration cartridge of claim 6, wherein said at least two membrane bundles each comprise at least one tubular membrane.
8. The filtration cartridge of claim 6, wherein said at least two membrane bundles comprise a plurality of hollow fiber membranes.
9. The filtration cartridge of claim 6, wherein said at least one support column comprises at least two support columns, and wherein at least one of said at least two membrane bundles is contained within at least one of said at least two support columns.
10. The filtration cartridge of claim 6, further comprising netting extending circumferentially around said interior surface of said housing.
11. The filtration cartridge of claim 6, wherein said support column includes openings through said outer wall to said inner channel.
12. The filtration cartridge of claim 11, wherein said openings comprise slots.
13. The filtration cartridge of claim 11, wherein said openings comprise holes.
14. The filtration cartridge of claim 11, wherein said openings comprise slots and holes.
15. The filtration cartridge of claim 6, further comprising netting extending circumferentially around each of said first and second ends of said at least one support column.
16. The filtration cartridge of claim 6, further comprising netting extending circumferentially around said at least one contained membrane bundle.

17. The filtration cartridge of claim 6 further comprising netting extending circumferentially around said at least one contained membrane bundle, wherein said netting extends beyond and folds back around at least one end of said at least one support column.
18. The filtration cartridge of claim 1, further comprising at least one permeate tube for receiving and removing permeate which has passed through said membrane bundle, said permeate tube being coupled with said outlet.
19. The filtration cartridge of claim 18, wherein said at least one permeate tube extends between said first and second end fittings such that the outer surface of said permeate tube adjacent each of said first and second open ends is embedded in said potted end caps.
20. The filtration cartridge of claim 19, wherein said at least one permeate tube includes openings through said outer surface to said inner channel.
21. The filtration cartridge of claim 20, wherein said openings comprise slots.
22. The filtration cartridge of claim 20 wherein said openings comprise holes.
23. The filtration cartridge of claim 20 wherein said openings comprise slots and holes.

24. A reinforced filtration cartridge having an inlet for receiving fluid to be filtered, and an outlet for removing filtered fluid, said cartridge comprising:
- a substantially cylindrical housing having an interior surface and first and second ends; first and second end fittings, wherein each of said end fittings is substantially cylindrical; potting compound disposed within each of said first and second end fittings;
 - at least two tubular support columns, each comprising first and second ends, an outer wall and an inner channel, and openings through said outer wall to said inner channel, wherein said at least two tubular support columns extend between said first and second end fittings, such that said first and second ends are embedded in said potting compound without extending through said potting compound;
 - at least three membrane bundles extending between said first and second end fittings, wherein at least one of said at least three membrane bundles is contained within each of said at least two tubular support columns, said membrane bundles being coupled with said inlet; and
 - at least one permeate tube within said cartridge for receiving and removing permeate which has passed through said membrane bundle, said permeate tube being coupled with said outlet.
25. The filtration cartridge of claim 24, wherein said at least three membrane bundles each comprise at least one tubular membrane.
26. The filtration cartridge of claim 24, wherein said at least three membrane bundles comprise a plurality of hollow fiber membranes.

27. A method of making a reinforced filtration cartridge having a housing for a filtration membrane, said method comprising the steps of:
positioning a support column within said housing;
packing membrane bundles within said housing proximate said support column;
placing first and second end fittings on opposing ends of said housing; and
dispersing potting compound into each of said first and second end fittings to form end caps such that the ends of said support column are embedded within said potting compound.
28. The method of making a reinforced filtration cartridge of claim 27, wherein said membrane bundles comprise at least one tubular membrane.
29. The method of making a reinforced filtration cartridge of claim 27, wherein said membrane bundles comprise a plurality of hollow fiber membranes.
30. The method of making a reinforced filtration cartridge of claim 27, further comprising the step of:
inserting a membrane bundle into said support column;
31. The method of making a reinforced filtration cartridge of claim 27, further comprising the step of wrapping netting around each end of said support column.

32. A method of filtering a fluid utilizing a cartridge filled with a filtration membrane, said method comprising the steps of:

arranging said filtration membrane in a plurality of longitudinally extending parallel bundles within said cartridge;

providing a permeate tube in said cartridge for receiving and removing permeate which has passed through said filtration membrane;

placing at least one support column within said cartridge to provide structural strength to said cartridge;

potting the ends of said cartridge to support said bundles;

embedding the ends of said at least one support column within said potting compound while not allowing said ends to pass through the potting compound; and

passing said fluid to be filtered through said cartridge.

33. The method of claim 32, wherein said filtration membrane comprises hollow fiber membranes.

34. The method of claim 32, wherein said filtration membrane comprises at least one tubular membrane.

35. A method of filtering a fluid utilizing a cartridge filled with a filtration membrane, said method comprising the steps of:
- arranging said filtration membrane in a plurality of longitudinally extending parallel bundles within said cartridge;
 - providing at least one opening within said cartridge for receiving and removing permeate which has passed through said filtration membrane;
 - placing at least one support column within said cartridge to provide structural strength to said cartridge;
 - potting the ends of said cartridge to support said bundles;
 - embedding the ends of said at least one support column within said potting compound while not allowing said ends to pass through the potting compound; and
 - passing said fluid to be filtered through said cartridge.
36. The method of claim 35, wherein said filtration membrane comprises hollow fiber membranes.
37. The method of claim 35, wherein said filtration membrane comprises at least one tubular membrane.

38. A method of sludge dewatering utilizing a cartridge filled with a filtration membrane, said method comprising the steps of:
- arranging said filtration membrane in a plurality of longitudinally extending parallel bundles within said cartridge;
 - providing a permeate tube in said cartridge for receiving and removing permeate which has passed through said filtration membrane;
 - placing at least one support column within said cartridge to provide structural strength to said cartridge;
 - potting the ends of said cartridge to support said bundles;
 - embedding the ends of said at least one support column within said potting compound while not allowing said ends to pass through the potting compound; and
 - passing said sludge to be dewatered through said cartridge.
39. The method of claim 38, wherein said filtration membrane comprises hollow fiber membranes.
40. The method of claim 38, wherein said filtration membrane comprises at least one tubular membrane.

41. A method of sludge dewatering utilizing a cartridge filled with a filtration membrane, said method comprising the steps of:
- arranging said filtration membrane in a plurality of longitudinally extending parallel bundles within said cartridge;
 - providing at least one opening within said cartridge for receiving and removing permeate which has passed through said filtration membrane;
 - placing at least one support column within said cartridge to provide structural strength to said cartridge;
 - potting the ends of said cartridge to support said bundles;
 - embedding the ends of said at least one support column within said potting compound while not allowing said ends to pass through the potting compound; and
 - passing said sludge to be dewatered through said cartridge.
42. The method of claim 41, wherein said filtration membrane comprises hollow fiber membranes.
43. The method of claim 41, wherein said filtration membrane comprises at least one tubular membrane.